PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-327560

(43)Date of publication of application : 13.12.1996

(51)Int.Cl. G01N 21/88
G06T 7/00

(21)Application number : 07-131531

(22)Date of filing : 30.05.1995

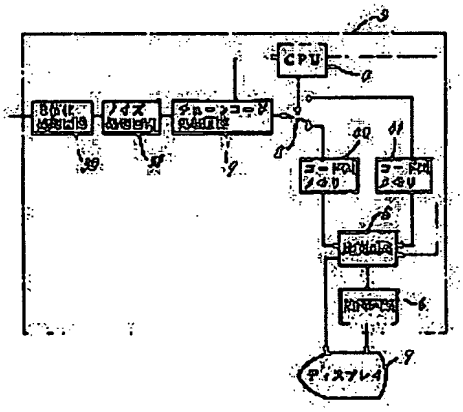
(71)Applicant : SANYO ELECTRIC CO LTD

(72)Inventor : YAMAMOTO FUMIHIKO
KIHARA HITOSHI
NAGAI YASUHIRO

(54) DEVICE AND METHOD FOR INSPECTING SHAPE

(57)Abstract:

PURPOSE: To rapidly detect any defect in shape of a subject for detection and its position by converting the positions of plural parting points set on the contour of an image into a chain code, and comparing the chain code with the contour code line of a reference image for every block.



CONSTITUTION: A reference image of, e.g. a tablet to be inspected is binarized 30 at a predetermined threshold, noises resulting from contraction and swelling are eliminated, and the overall periphery of its contour is converted into a chain code 9, which is then stored in a code line memory 40. The permissible error of a block length obtained from a code line and the permissible error of the coordinates of each parting point on the contour are set in a comparison circuit 5. Then, an image of the tablet to be inspected is similarly processed by an image processing circuit 3, the arrangement of its chain code is stored in an encoding memory 41, and block lengths obtained from the chain code arrangements stored in the memories 40, 41 are compared for every block by the circuit 5, and when the difference between the block lengths is out of the permissible error, the coordinates of the parting points are compared, and when the difference between the coordinates is in excess of its permissible error, the corresponding block is determined to

contain defects, and the coordinates of its parting point are displayed 7.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to an inspected object, for example, the configuration test equipment which detects the correction of the appearance configuration of a tablet, and the configuration inspection approach.
[0002]
[Description of the Prior Art] In the production process of an object, in order to automate the business which inspects the correction of the appearance configuration of an object, configuration test equipment (1) as shown in drawing 1 is proposed. **** test equipment is used for configuration inspection of a tablet etc. in many cases, and illustrates a tablet as an inspected object in the following publications. This test equipment (1) forms the lamp (11) which compares a camera (10) above the tablet (2) conveyed on the band conveyor (12), and compares a tablet (2) with the side of a camera (10) from the slanting upper part, respectively. The image of the tablet (2) irradiated with the lamp (11) is sent to an image-processing circuit (3) through a camera (10). In an image-processing circuit (3), the obtained image is binary--ization-processed and image recognition processing is performed based on this binary-ized image.
[0003] The image-processing circuit (3) is made to memorize first the image data of the normal of the tablet (2) which should be detected as criteria image data. Said binary-ized image data and criteria image data are compared, and a tablet (2) judges whether it is the configuration of normal. As this decision technique, the border line of the technique by the so-called labeling processing of [area / of an image / criteria image data] or image data is measured, and there is technique [criteria image data / die length / of this border line]. Labeling processing is processing which considers that those pixel groups are one group, and assigns a label with a figure or a notation when a pixel adjoins and exists in image data here, and when the contiguity pixel generally exists in vertical and horizontal any they are, 4 connection labeling processing it is considered that is one group is used (refer to 45 pages - "image-processing-fundamentals technique" (technical Hyoronsha issue) 49 pages).
[0004]
[Problem(s) to be Solved by the Invention] In conventional configuration test equipment, since the configuration of a tablet (2) is inspecting whether it is normal by the area or the boundary length of image data, when faults, such as a chip and a swelling, are in the configuration of a tablet (2), for example, even if it can distinguish, it is not understood whether which part is poor that the configuration of a tablet (2) is poor. Moreover, since all the elements of both image data are compared and the defect is distinguished, by the time it obtains a distinction result, it will take time amount. This invention aims at pinpointing the location of a fault and detecting the defect of a detected material quickly in the configuration test equipment which detects the defect of the configuration of a detected material.
[0005]
[Means for Solving the Problem] The chain code processing circuit which configuration test equipment sets up two or more dividing points on the profile of the captured image, and expresses the location of

each dividing point with a code (9), The memory which classifies and stores the code train which shows the profile of a criteria image for every predetermined section (40), While connecting with the memory (41) which stores the code train corresponding to this partition which shows the profile of an inspected object for every section, both memory (40), and (41) The allowable error between the code trains stored in both memory (40) and (41) is set up beforehand. It has the comparator circuit (5) which outputs the code train stored in both memory (40) and (41) with the data of a section location [/ information / on this difference] when the difference beyond an allowable error is detected as compared with the order of the section. Moreover, the allowable error beforehand set as the comparator circuit (5) consists of the allowable error over the section length obtained from a code train, and the allowable error over the coordinate of the dividing point on a profile.

[0006]

[Function and Effect] A comparator circuit (5) outputs the information on this difference with the data of the compared section location, when the difference exceeding an allowable error [as opposed to the coordinate of section length and a dividing point for the code train stored in both memory (40) and (41)] is detected as compared with the order of the section. Therefore, when a fault is one of inspected objects, it can specify in which location this fault exists. moreover, the conventional equipment which compares the whole surface product and perimeter length of a tablet (2) since a fault is searched in order of the section -- comparing -- discovery of a fault -- base -- it can do quickly.

[0007]

[Example] Hereafter, it explains in full detail using a drawing per example of this invention. As shown in drawing 1 , configuration test equipment (1) is equipped with the image-processing circuit (3) connected with the camera (10), and the lamp (11) which irradiates a tablet (2) and a camera (10) as usual. A camera (10) projects the tablet (2) irradiated by the lamp (11), and the projection image is sent to an image-processing circuit (3). In this example, the description is in the image processing in an image-processing circuit (3). Drawing 2 is the block diagram showing the internal configuration of an image-processing circuit (3). An image-processing circuit (3) is equipped with a binary-ized processing circuit (30), a noise processing circuit (31), and a chain code processing circuit (9) in order toward an output side from an input side, and connects this chain code processing circuit (9) to two code train memory (40) and (41) alternatively through a circuit changing switch (8). Near the circuit changing switch (8), CPU (4) is prepared and this circuit changing switch (8) is switched by CPU (4). The outgoing end of code train memory (40) and (41) is connected to the comparator circuit (5). The graphic form information from a comparator circuit (5) is sent to a drawing circuit (6), and a drawing circuit (6) displays the drawn image on a display (7). Hereafter, actuation of each circuit is explained using the flow chart of drawing 3 and drawing 4 .

[0008] First, the image of the tablet (2) used as criteria is captured with a camera (10) (S1). With predetermined threshold level, the image of the incorporated tablet (2) is binary--ization-processed in a binary-ized processing circuit (30), as shown in drawing 11 (S2). Then, a binary-ized image performs noise rejection processing which consists of contraction and expansion in a noise processing circuit (31). Contraction processing is shown below. The pixel condition before contraction processing is shown in drawing 12 (a), and the pixel condition after contraction processing is shown in drawing 12 (b). At drawing 12 , a dot shows the other image part for a graphic element by **1**.

[0009] A screen is first divided into the partition of a pixel unit, and each pixel on a screen is detected. And the pixel located in the four directions of the point whose pixel is a dot is erased from a screen. For example, in drawing 12 (a), the pixel of eye two-line trains [two trains] is **1**, and since an vertical and horizontal pixel is a dot, in drawing 12 (b), the pixel of eye these two-line trains [two trains] serves as a dot. It is the processing which makes it produce a pixel when there is no pixel in the point located in the four directions of the pixel of arbitration contrary to [contraction processing] expansion processing. Drawing 12 (c) is in the pixel condition after carrying out expansion processing of the pixel condition shown in drawing 12 (b) (refer to 54 pages - the aforementioned "image-processing-fundamentals technique" (technical Hyoronsha issue) 56 pages). A noise is removed by performing such contraction / expansion processing several times.

[0010] The image after the noise was removed is sent to a chain code processing circuit (9) (S3). CPU (4) connects a circuit changing switch (8) with one code train memory (40). Here, chain code processing sets up a reference point and two or more dividing points on the border line of an image, expresses the sense of each dividing point over a reference point with the figure called a direction code, and expresses the profile of an image by the digit string (refer to 93 pages - "computer-image-processing" (SANPO PUBLICATIONS) 95 pages). A direction code shows the direction of the dividing point over a reference point in order in the figure to 0-7, as shown in drawing 5 . When the direction of the dividing point over a reference point is not in agreement in the direction of [to 0-7], a nearby direction code shows. In this example, as shown in drawing 6 , while preparing the profile of a tablet (2) on X-Y coordinate, four points A, B, C, and D which separated mutually clockwise are first set up at equal intervals on this border line. The first reference point is set to A and the coordinate is set to (0, 0). The coordinate location of each dividing point is expressed with a direction code, and a chain code array is created about each section length so that two or more dividing points may be later set up and mentioned at equal intervals next, respectively about the four sections, A-B, B-C, C-D, and D-A. In addition, although the configuration of a tablet (2) is circular, 8 after [expedient] explaining square shape is resembled, and drawing 6 shows it.

[0011] The procedure of a chain code array is shown below. Two or more dividing points are defined at equal intervals within each section. In the example shown in drawing 6 , a dividing point (21) and (22) are set for one dividing point (20) to a corner between this point (20) and Points A and B, respectively. Next, it searches sequentially from A in which direction the next point is located to the point used as criteria in the counterclockwise direction, and it is expressed with a direction code. Although many dividing points are set up within each section in actual chain code processing, the point dividing after [expedient] explaining is set to three in drawing 6 .

[0012] In drawing 6 , the dividing point (21) which adjoins each other by the counterclockwise rotation side to a reference point A is located in the negative direction of the X-axis, and the forward direction of a Y-axis. That is, the direction code of a dividing point (21) turns into a code of "5" shown in drawing 5 R> 5. Chain code processing circuit (9) once memorizes the code of "5", and makes the coordinate of dividing point (21) (-1 and 1). Next, a reference point is transposed to a dividing point (21), and the dividing point (20) which adjoins each other by the counterclockwise rotation side from this point (21) is measured. The direction code of a dividing point (20) is set to "5." "5" which is the direction code of a dividing point (20) after the code of "5" which memorized the chain code processing circuit (9) previously -- memorizing -- the coordinate of this point (20) -- (-- it considers as -2 and 2).

[0013] Hereafter, if the same actuation is repeated, in section A-B, a chain code array will be set to 5566 and the coordinate of Point B will become (-2 and 4). Hereafter, the above-mentioned actuation is carried out also in other sections, and a chain code array is acquired about the dividing point of the border-line perimeter of a tablet (2). A chain code array is memorized by code train memory (40) through a circuit changing switch (8). In addition, the coordinate of each dividing point is restored from a chain code array in a comparator circuit (5) so that a postscript may be carried out.

[0014] If the completion of storing of the chain code array of the tablet (2) which should serve as criteria with the flowchart of drawing 3 is carried out at code train memory (40) (S5), a user will decide whether to capture an inspection image (S6). When capturing an inspection image, a band conveyor (12) is operated and the tablet (2) which should be inspected is set as the location which countered the camera (10). CPU (4) switches a circuit changing switch (8), and connects a chain code processing circuit (9) with different code train memory (41) from the code train memory (40) the chain code array was previously remembered to be electrically (S7). Also with the image of the tablet (2) which should be inspected, an image processing circuit (3) performs the same processing as the above, and stores the acquired chain code array in code train memory (41).

[0015] If the completion of an input of the chain code array is carried out at code train memory (41), CPU (4) operates a comparator circuit (5) and a comparator circuit (5) compares the section length obtained from the chain code array stored in both code train memory (40) and (41) for every section (S8). For example, in section A-B, since a chain code array consists of 5566 and four codes, section

length is 4. The allowable error of section length and the allowable error of the coordinate of each dividing point which can be read in each code are beforehand memorized for every section in the comparator circuit (5). In here, even if the allowable error of section length and the allowable error of the coordinate of each dividing point have a chip and a swelling to the tablet (2) used as criteria, they are determined from the amount allowed on the efficacy of a tablet (2). Moreover, if it is the configuration where covered the perimeter of a tablet (2) and slight irregularity continued as shown, for example in drawing 8 , although section length will exceed an allowable error, there are some which are allowed on the efficacy of a tablet (2). it is not considered that even this tablet (2) is a defect -- as -- the allowable error of section length -- in addition, it has set up to the allowable error of the coordinate of each dividing point.

[0016] In the one section, a comparator circuit (5) will be compared about (S9) and the next section, if the difference of section length is in an allowable error. It judges whether the comparator circuit (5) compared about the profile perimeter of a tablet (2) (S11), and in all the sections, if it judges that it is less than an allowable error, the signal that he has no abnormalities will be emitted (S12). In the one section, if the difference of section length acquired from a chain code array is outside an allowable error, it will shift to step S10, the coordinate of a dividing point will be restored from a code, and the coordinates of the point within this section will be compared. With [a coordinate difference] an allowable error [less than], the section length of the next section is compared (S11). If the coordinate difference is over the allowable error, it will judge that a comparator circuit (5) has a defect within this section, and the coordinate of the dividing point exceeding an allowable error will be sent to a drawing circuit (6). A comparator circuit (5) draws the part judged to be a defect (S13), and displays a drawing circuit (6) on a display (7) (S14).

[0017] Actuation of the comparator circuit (5) shown in S14 from step S8 of a flow chart is concretely shown supposing the case where it dents and there is (28) in section A-B, as shown in drawing 7 . In the following publications, 1 and the allowable error of a coordinate are assumed to be 0.5 for the allowable error of section length, respectively. A depression (28) is formed ranging from the dividing point (20) to Point B, and the chain code array is created beforehand in the chain code processing circuit (9). On the profile of a depression (28), three dividing points (23), (24), and (25) are set up, and the chain code array to Point B is set to 0664 from a dividing point (23). Therefore, in section A-B, a chain code array is set to 550664 and section length is set to 6. Since a chain code array is 5566 by the image of the normal of a tablet (2) like the above-mentioned and section length is 4, the difference of section length is set to 2. Since the difference of section length is beyond an allowable error, a comparator circuit (5) distinguishes that a fault is in section A-B. Since the code of the point [dividing / 2nd] (20) corresponds from a reference point A and codes differ from this point (20) before Point B, it turns out that there is a fault in the meantime.

[0018] A comparator circuit (5) searches for the coordinate of each dividing point (20), (23), (24), and (25) from the code train 0664 which shows a fault. Next, this coordinate is compared with the coordinate of a criteria image. Drawing 9 (b) expresses the code train and coordinate of an inspection image for the code train and coordinate of a criteria image, respectively. [in / in drawing 9 (a) / section A-B] When the coordinate of both images is compared, there are not a dividing point (22) and a thing which is dented and is settled in an allowable error to the coordinate of the image of the other party about the coordinate of the dividing point on (28) (23), (24), and (25). That is, it turns out that the tablet (2) shown in an inspection image has a fault in section A-B to the image of the tablet (2) shown in a criteria image. A comparator circuit (5) sends the coordinate data of the point B which sandwiches the dividing point (22) which constitutes a fault, (23), (24), (25), and a dividing point (23), (24), and (25), and a dividing point (20) to a drawing circuit (6). A drawing circuit (6) draws a graphic form based on this coordinate data.

[0019] It becomes the shape of a rectangle which shows that this graphic form is dented as shown in drawing 10 , and it has (28), and it dents on a display (7) and the graphic form and section A-B of (28) are shown in it. Thus, the section and the configuration of a fault of a tablet (2) are known. the section which took out the tablet (2) and was displayed on the display (7) when this tablet (2) judged the

operator who is looking at the display (7) to be poor -- a fault and its configuration -- base -- it can check quickly. In addition, the tablet (2) judged to be poor is further conveyed on a band conveyor (12), after checking a fault and its configuration. With the drawing equipment (not shown) coordinated with the image-processing circuit (3) next, although this tablet (2) can also be sampled, this drawing equipment is a well-known technique, and omits a publication.

[0020] In this example, the profile of a tablet (2) is searched at the predetermined section, a fault is searched for every partition opium poppy and section, and if there is a fault, the configuration will be displayed. therefore, the conventional equipment which compares the whole surface product and perimeter length of a tablet (2) -- comparing -- discovery of a fault -- base -- it can do quickly and the location of a fault can also be pinpointed easily. In this example, although the tablet was illustrated as an inspected object, it cannot be overemphasized that can apply this example to the test equipment of not only a tablet but various configurations.

[0021] Explanation of the above-mentioned example is for explaining this invention, and it should not be understood so that invention of a publication may be limited to a claim or the range may be ****(ed). Moreover, as for each part configuration of this invention, it is needless to say for deformation various by technical within the limits given not only in the above-mentioned example but a claim to be possible.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention relates to an inspected object, for example, the configuration test equipment which detects the correction of the appearance configuration of a tablet, and the configuration inspection approach.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] In the production process of an object, in order to automate the business which inspects the correction of the appearance configuration of an object, configuration test equipment (1) as shown in drawing 1 is proposed. **** test equipment is used for configuration inspection of a tablet etc. in many cases, and illustrates a tablet as an inspected object in the following publications. This test equipment (1) forms the lamp (11) which compares a camera (10) above the tablet (2) conveyed on the band conveyor (12), and compares a tablet (2) with the side of a camera (10) from the slanting upper part, respectively. The image of the tablet (2) irradiated with the lamp (11) is sent to an image-processing circuit (3) through a camera (10). In an image-processing circuit (3), the obtained image is binary--ization-processed and image recognition processing is performed based on this binary-ized image.

[0003] The image-processing circuit (3) is made to memorize first the image data of the normal of the tablet (2) which should be detected as criteria image data. Said binary-ized image data and criteria image data are compared, and a tablet (2) judges whether it is the configuration of normal. As this decision technique, the border line of the technique by the so-called labeling processing of [area / of an image / criteria image data] or image data is measured, and there is technique [criteria image data / die length / of this border line]. Labeling processing is processing which considers that those pixel groups are one group, and assigns a label with a figure or a notation when a pixel adjoins and exists in image data here, and when the contiguity pixel generally exists in vertical and horizontal any they are, 4 connection labeling processing it is considered that is one group is used (refer to 45 pages - "image-processing-fundamentals technique" (technical Hyoronsha issue) 49 pages).

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In conventional configuration test equipment, since the configuration of a tablet (2) is inspecting whether it is normal by the area or the boundary length of image data, when faults, such as a chip and a swelling, are in the configuration of a tablet (2), for example, even if it can distinguish, it is not understood whether which part is poor that the configuration of a tablet (2) is poor. Moreover, since all the elements of both image data are compared and the defect is distinguished, by the time it obtains a distinction result, it will take time amount. This invention aims at pinpointing the location of a fault and detecting the defect of a detected material quickly in the configuration test equipment which detects the defect of the configuration of a detected material.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] The chain code processing circuit which configuration test equipment sets up two or more dividing points on the profile of the captured image, and expresses the location of each dividing point with a code (9), The memory which classifies and stores the code train which shows the profile of a criteria image for every predetermined section (40), While connecting with the memory (41) which stores the code train corresponding to this partition which shows the profile of an inspected object for every section, both memory (40), and (41) The allowable error between the code trains stored in both memory (40) and (41) is set up beforehand. It has the comparator circuit (5) which outputs the code train stored in both memory (40) and (41) with the data of a section location [/ information / on this difference] when the difference beyond an allowable error is detected as compared with the order of the section. Moreover, the allowable error beforehand set as the comparator circuit (5) consists of the allowable error over the section length obtained from a code train, and the allowable error over the coordinate of the dividing point on a profile.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EXAMPLE

[Example] Hereafter, it explains in full detail using a drawing per example of this invention. As shown in drawing 1 , configuration test equipment (1) is equipped with the image-processing circuit (3) connected with the camera (10), and the lamp (11) which irradiates a tablet (2) and a camera (10) as usual. A camera (10) projects the tablet (2) irradiated by the lamp (11), and the projection image is sent to an image-processing circuit (3). In this example, the description is in the image processing in an image-processing circuit (3). Drawing 2 is the block diagram showing the internal configuration of an image-processing circuit (3). An image-processing circuit (3) is equipped with a binary-ized processing circuit (30), a noise processing circuit (31), and a chain code processing circuit (9) in order toward an output side from an input side, and connects this chain code processing circuit (9) to two code train memory (40) and (41) alternatively through a circuit changing switch (8). Near the circuit changing switch (8), CPU (4) is prepared and this circuit changing switch (8) is switched by CPU (4). The outgoing end of code train memory (40) and (41) is connected to the comparator circuit (5). The graphic form information from a comparator circuit (5) is sent to a drawing circuit (6), and a drawing circuit (6) displays the drawn image on a display (7). Hereafter, actuation of each circuit is explained using the flow chart of drawing 3 and drawing 4 .

[0008] First, the image of the tablet (2) used as criteria is captured with a camera (10) (S1). With predetermined threshold level, the image of the incorporated tablet (2) is binary--ization-processed in a binary-ized processing circuit (30), as shown in drawing 11 (S2). Then, a binary-ized image performs noise rejection processing which consists of contraction and expansion in a noise processing circuit (31). Contraction processing is shown below. The pixel condition before contraction processing is shown in drawing 12 (a), and the pixel condition after contraction processing is shown in drawing 12 (b). At drawing 12 , a dot shows the other image part for a graphic element by **1**.

[0009] A screen is first divided into the partition of a pixel unit, and each pixel on a screen is detected. And the pixel located in the four directions of the point whose pixel is a dot is erased from a screen. For example, in drawing 12 (a), the pixel of eye two-line trains [two trains] is **1**, and since an vertical and horizontal pixel is a dot, in drawing 12 (b), the pixel of eye these two-line trains [two trains] serves as a dot. It is the processing which makes it produce a pixel when there is no pixel in the point located in the four directions of the pixel of arbitration contrary to [contraction processing] expansion processing. Drawing 12 (c) is in the pixel condition after carrying out expansion processing of the pixel condition shown in drawing 12 (b) (refer to 54 pages - the aforementioned "image-processing-fundamentals technique" (technical Hyoronsha issue) 56 pages). A noise is removed by performing such contraction / expansion processing several times.

[0010] The image after the noise was removed is sent to a chain code processing circuit (9) (S3). CPU (4) connects a circuit changing switch (8) with one code train memory (40). Here, chain code processing sets up a reference point and two or more dividing points on the border line of an image, expresses the sense of each dividing point over a reference point with the figure called a direction code, and expresses the profile of an image by the digit string (refer to 93 pages - "computer-image-processing" (SANPO PUBLICATIONS) 95 pages). A direction code shows the direction of the dividing point over a reference

point in order in the figure to 0-7, as shown in drawing 5 . When the direction of the dividing point over a reference point is not in agreement in the direction of [to 0-7], a nearby direction code shows. In this example, as shown in drawing 6 , while preparing the profile of a tablet (2) on X-Y coordinate, four points A, B, C, and D which separated mutually clockwise are first set up at equal intervals on this border line. The first reference point is set to A and the coordinate is set to (0, 0). The coordinate location of each dividing point is expressed with a direction code, and a chain code array is created about each section length so that two or more dividing points may be later set up and mentioned at equal intervals next, respectively about the four sections, A-B, B-C, C-D, and D-A. In addition, although the configuration of a tablet (2) is circular, 8 after [expedient] explaining square shape is resembled, and drawing 6 shows it.

[0011] The procedure of a chain code array is shown below. Two or more dividing points are defined at equal intervals within each section. In the example shown in drawing 6 , a dividing point (21) and (22) are set for one dividing point (20) to a corner between this point (20) and Points A and B, respectively. Next, it searches sequentially from A in which direction the next point is located to the point used as criteria in the counterclockwise direction, and it is expressed with a direction code. Although many dividing points are set up within each section in actual chain code processing, the point dividing after [expedient] explaining is set to three in drawing 6 .

[0012] In drawing 6 , the dividing point (21) which adjoins each other by the counterclockwise rotation side to a reference point A is located in the negative direction of the X-axis, and the forward direction of a Y-axis. That is, the direction code of a dividing point (21) turns into a code of "5" shown in drawing 5 R> 5. Chain code processing circuit (9) once memorizes the code of "5", and makes the coordinate of dividing point (21) (-1 and 1). Next, a reference point is transposed to a dividing point (21), and the dividing point (20) which adjoins each other by the counterclockwise rotation side from this point (21) is measured. The direction code of a dividing point (20) is set to "5." "5" which is the direction code of a dividing point (20) after the code of "5" which memorized the chain code processing circuit (9) previously -- memorizing -- the coordinate of this point (20) -- (-- it considers as -2 and 2).

[0013] Hereafter, if the same actuation is repeated, in section A-B, a chain code array will be set to 5566 and the coordinate of Point B will become (-2 and 4). Hereafter, the above-mentioned actuation is carried out also in other sections, and a chain code array is acquired about the dividing point of the border-line perimeter of a tablet (2). A chain code array is memorized by code train memory (40) through a circuit changing switch (8). In addition, the coordinate of each dividing point is restored from a chain code array in a comparator circuit (5) so that a postscript may be carried out.

[0014] If the completion of storing of the chain code array of the tablet (2) which should serve as criteria with the flow chart of drawing 3 is carried out at code train memory (40) (S5), a user will decide whether to capture an inspection image (S6). When capturing an inspection image, a band conveyor (12) is operated and the tablet (2) which should be inspected is set as the location which countered the camera (10). CPU (4) switches a circuit changing switch (8), and connects a chain code processing circuit (9) with different code train memory (41) from the code train memory (40) the chain code array was previously remembered to be electrically (S7). Also with the image of the tablet (2) which should be inspected, an image-processing circuit (3) performs the same processing as the above, and stores the acquired chain code array in code train memory (41).

[0015] If the completion of an input of the chain code array is carried out at code train memory (41), CPU (4) operates a comparator circuit (5) and a comparator circuit (5) compares the section length obtained from the chain code array stored in both code train memory (40) and (41) for every section (S8). For example, in section A-B, since a chain code array consists of 5566 and four codes, section length is 4. The allowable error of section length and the allowable error of the coordinate of each dividing point which can be read in each code are beforehand memorized for every section in the comparator circuit (5). In here, even if the allowable error of section length and the allowable error of the coordinate of each dividing point have a chip and a swelling to the tablet (2) used as criteria, they are determined from the amount allowed on the efficacy of a tablet (2). Moreover, if it is the configuration where covered the perimeter of a tablet (2) and slight irregularity continued as shown, for example in

drawing 8 , although section length will exceed an allowable error, there are some which are allowed on the efficacy of a tablet (2). it is not considered that even this tablet (2) is a defect -- as -- the allowable error of section length -- in addition, it has set up to the allowable error of the coordinate of each dividing point.

[0016] In the one section, a comparator circuit (5) will be compared about (S9) and the next section, if the difference of section length is in an allowable error. It judges whether the comparator circuit (5) compared about the profile perimeter of a tablet (2) (S11), and in all the sections, if it judges that it is less than an allowable error, the signal that he has no abnormalities will be emitted (S12). In the one section, if the difference of section length acquired from a chain code array is outside an allowable error, it will shift to step S10, the coordinate of a dividing point will be restored from a code, and the coordinates of the point within this section will be compared. With [a coordinate difference] an allowable error [less than], the section length of the next section is compared (S11). If the coordinate difference is over the allowable error, it will judge that a comparator circuit (5) has a defect within this section, and the coordinate of the dividing point exceeding an allowable error will be sent to a drawing circuit (6). A comparator circuit (5) draws the part judged to be a defect (S13), and displays a drawing circuit (6) on a display (7) (S14).

[0017] Actuation of the comparator circuit (5) shown in S14 from step S8 of a flow chart is concretely shown supposing the case where it dents and there is (28) in section A-B, as shown in drawing 7 . In the following publications, 1 and the allowable error of a coordinate are assumed to be 0.5 for the allowable error of section length, respectively. A depression (28) is formed ranging from the dividing point (20) to Point B, and the chain code array is created beforehand in the chain code processing circuit (9). On the profile of a depression (28), three dividing points (23), (24), and (25) are set up, and the chain code array to Point B is set to 0664 from a dividing point (23). Therefore, in section A-B, a chain code array is set to 550664 and section length is set to 6. Since a chain code array is 5566 by the image of the normal of a tablet (2) like the above-mentioned and section length is 4, the difference of section length is set to 2. Since the difference of section length is beyond an allowable error, a comparator circuit (5) distinguishes that a fault is in section A-B. Since the code of the point [dividing / 2nd] (20) corresponds from a reference point A and codes differ from this point (20) before Point B, it turns out that there is a fault in the meantime.

[0018] A comparator circuit (5) searches for the coordinate of each dividing point (20), (23), (24), and (25) from the code train 0664 which shows a fault. Next, this coordinate is compared with the coordinate of a criteria image. Drawing 9 (b) expresses the code train and coordinate of an inspection image for the code train and coordinate of a criteria image, respectively. [in / in drawing 9 (a) / section A-B] When the coordinate of both images is compared, there are not a dividing point (22) and a thing which is dented and is settled in an allowable error to the coordinate of the image of the other party about the coordinate of the dividing point on (28) (23), (24), and (25). That is, it turns out that the tablet (2) shown in an inspection image has a fault in section A-B to the image of the tablet (2) shown in a criteria image. A comparator circuit (5) sends the coordinate data of the point B which sandwiches the dividing point (22) which constitutes a fault, (23), (24), (25), and a dividing point (23), (24) and (25), and a dividing point (20) to a drawing circuit (6). A drawing circuit (6) draws a graphic form based on this coordinate data.

[0019] It becomes the shape of a rectangle which shows that this graphic form is dented as shown in drawing 10 , and it has (28), and it dents on a display (7) and the graphic form and section A-B of (28) are shown in it. Thus, the section and the configuration of a fault of a tablet (2) are known. the section which took out the tablet (2) and was displayed on the display (7) when this tablet (2) judged the operator who is looking at the display (7) to be poor -- a fault and its configuration -- base -- it can check quickly. In addition, the tablet (2) judged to be poor is further conveyed on a band conveyor (12), after checking a fault and its configuration. With the drawing equipment (not shown) coordinated with the image-processing circuit (3) next, although this tablet (2) can also be sampled, this drawing equipment is a well-known technique, and omits a publication.

[0020] In this example, the profile of a tablet (2) is searched at the predetermined section, a fault is

searched for every partition opium poppy and section, and if there is a fault, the configuration will be displayed. therefore, the conventional equipment which compares the whole surface product and perimeter length of a tablet (2) -- comparing -- discovery of a fault -- base -- it can do quickly and the location of a fault can also be pinpointed easily. In this example, although the tablet was illustrated as an inspected object, it cannot be overemphasized that can apply this example to the test equipment of not only a tablet but various configurations.

[0021] Explanation of the above-mentioned example is for explaining this invention, and it should not be understood so that invention of a publication may be limited to a claim or the range may be ****(ed). Moreover, as for each part configuration of this invention, it is needless to say for deformation various by technical within the limits given not only in the above-mentioned example but a claim to be possible.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平8－327560

(43)公開日　平成８年(1996)12月13日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ		技術表示箇所
Ｇ０１Ｎ　21/88			Ｇ０１Ｎ　21/88	Ｊ	
Ｇ０６Ｔ　7/00			Ｇ０６Ｆ　15/62	４００	
		9061－5Ｈ	15/70	４６０Ｆ	

審査請求　未請求　請求項の数３　ＯＬ　（全７頁）

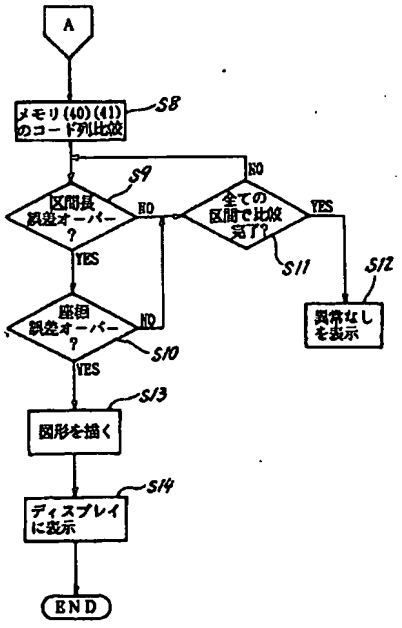
(21)出願番号　特願平7－131531

(22)出願日　平成７年(1995)５月30日

(71)出願人　000001889
三洋電機株式会社
大阪府守口市京阪本通２丁目５番５号
(72)発明者　山元　文彦
大阪府守口市京阪本通２丁目５番５号　三洋電機株式会社内
(72)発明者　木原　均
大阪府守口市京阪本通２丁目５番５号　三洋電機株式会社内
(72)発明者　永井　靖泰
大阪府守口市京阪本通２丁目５番５号　三洋電機株式会社内
(74)代理人　弁理士　丸山　敬之　（外２名）

(54)【発明の名称】　形状検査装置及び形状検査方法

(57)【要約】
【目的】　形状検査装置に於いて、不良箇所の位置を特定し、かつ被検出物の不良を速く検出する。
【構成】　基準画像と検査画像の輪郭は、チェーンコード化処理され、所定の区間毎に区分けされて、夫々メモリ40、41に格納される。両メモリ40、41は、両メモリ40、41に格納されたコード列間の許容誤差が、予め設定された比較回路5に繋がる。比較回路5は、両メモリ40、41に格納されたコード列を区間順に比較し、許容誤差以上の差を検出した時に、該差の情報を、比較した区間位置のデータとともに出力する。描画回路6は比較回路5からの情報に基づき、不良箇所と不良箇所が存在する区間をディスプレイ7に表示する。



2/21/2006, EAST Version: 2.0.3.0

1

【特許請求の範囲】

【請求項1】　カメラ(10)で取り込んだ被検査物の画像を2値化処理し、基準画像と比較して、被検査物の正誤を検査する形状検査装置に於いて、

取り込んだ画像の輪郭上に複数の分割点を略等間隔に設定し、各分割点から隣の分割点までの方向をコードで表わすチェーンコード処理回路(9)と、

基準画像の輪郭を示すコード列を、所定区間毎に区分して格納するメモリ(40)と、

該区分に対応した区間毎に被検査物の輪郭を示すコード列を格納するメモリ(41)と、

両メモリ(40)(41)に接続されるとともに、両メモリ(40)(41)に格納されたコード列間の許容誤差が予め設定されており、両メモリ(40)(41)に格納されたコード列を区間順に比較し、許容誤差以上の差を検出した時に、該差の情報を、比較した区間位置のデータとともに出力する比較回路(5)を具えたことを特徴とする形状検査装置。

【請求項2】　比較回路(5)に予め設定された許容誤差は、コード列から得られる区間長に対する許容誤差、及び輪郭上の分割点の座標に対する許容誤差とから成る請求項1に記載の形状検査装置。

【請求項3】　基準画像の輪郭を示すコードと、被検査物の輪郭を示すコードを、所定区間毎に区分して、夫々メモリ(40)(41)に格納し、両メモリ(40)(41)に格納されたコード列を区間順に比較し、許容誤差以上の両コード列の差を、比較した区間位置とともに出力する形状検査方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、被検査物、例えば錠剤の外形形状の正誤を検出する形状検査装置及び形状検査方法に関するものである。

【0002】

【従来の技術】物の製造工程に於いて、物の外形形状の正誤を検査する業務を自動化するために、図1に示すような形状検査装置(1)が提案されている。斯種検査装置は、錠剤等の形状検査に用いることが多く、以下の記載では、被検査物として錠剤を例示する。該検査装置(1)は、ベルトコンベア(12)により搬送されてきた錠剤(2)の上方にカメラ(10)を、カメラ(10)の側方に、錠剤(2)を斜め上方から照らすランプ(11)を夫々設ける。ランプ(11)により照射された錠剤(2)の画像は、カメラ(10)を介して、画像処理回路(3)に送られる。画像処理回路(3)では、得られた画像を2値化処理し、該2値化画像に基づき画像認識処理が実行される。

【0003】まず画像処理回路(3)には、検出すべき錠剤(2)の正規の画像データを基準画像データとして記憶させておく。前記2値化画像データと基準画像データを比較し、錠剤(2)が正規の形状か否かを判断する。この判断手法としては、画像の面積を基準画像データと比較する所謂ラベリング処理による手法、又は画像データの輪郭線を測定し、該輪郭線の長さを基準画像データと比較する手法がある。ここでラベリング処理とは、画像データ中に画素が隣接して存在する場合、それらの画素群を1つのグループと看做して、数字又は記号によるラベルを割り当てる処理であり、一般的には上下左右の何れかに隣接画素が存在しているときに、1グループと看做す4連結ラベリング処理が用いられる(「画像処理の基本技法」(技術評論社発行)45頁～49頁参照)。

2

【0004】

【発明が解決しようとする課題】従来の形状検査装置では、画像データの面積又は周囲長で、錠剤(2)の形状が正規か否かを検査しているので、例えば錠剤(2)の形状に欠けや膨らみ等の不良箇所があるときに、錠剤(2)の形状が不良であることは判別できても、どの箇所が不良であるかが判らない。また、両画像データの全ての要素を比較して不良を判別しているから、判別結果を得るまでに時間が掛る。本発明は、被検出物の形状の不良を検出する形状検査装置に於いて、不良箇所の位置を特定し、かつ被検出物の不良を速く検出することを目的とする。

【0005】

【課題を解決する為の手段】形状検査装置は、取り込んだ画像の輪郭上に複数の分割点を設定し、各分割点の位置をコードで表わすチェーンコード処理回路(9)と、基準画像の輪郭を示すコード列を、所定区間毎に区分して格納するメモリ(40)と、該区分に対応した区間毎に被検査物の輪郭を示すコード列を格納するメモリ(41)と、両メモリ(40)(41)に接続されるとともに、両メモリ(40)(41)に格納されたコード列間の許容誤差が予め設定され、両メモリ(40)(41)に格納されたコード列を区間順に比較し、許容誤差以上の差を検出した時に、該差の情報を、比較した区間位置のデータとともに出力する比較回路(5)を具えている。また、比較回路(5)に予め設定された許容誤差は、コード列から得られる区間長に対する許容誤差、及び輪郭上の分割点の座標に対する許容誤差とから成る。

【0006】

【作用及び効果】比較回路(5)は両メモリ(40)(41)に格納されたコード列を区間順に比較し、区間長及び分割点の座標に対する許容誤差を越える差を検出したときには、該差の情報を、比較した区間位置のデータとともに出力する。従って、被検査物に不良箇所があるときに、どの位置に該不良箇所が存在しているかが特定できる。また、区間順に不良箇所を検索するので、錠剤(2)の全面積や全周長を比較する従来の装置に比して、不良箇所の発見が桁違いに速くできる。

【0007】

【実施例】以下、本発明の一実施例につき図面を用いて詳述する。図1に示すように、形状検査装置(1)は、従

来と同様に、カメラ(10)と、錠剤(2)を照射するランプ(11)と、カメラ(10)に連結した画像処理回路(3)を具える。カメラ(10)は、ランプ(11)に照射された錠剤(2)を映写し、その映写画像は画像処理回路(3)に送られる。本実施例では、画像処理回路(3)での画像処理に特徴がある。図2は画像処理回路(3)の内部構成を示すブロック図である。画像処理回路(3)は入力側から出力側に向かって、2値化処理回路(30)、ノイズ処理回路(31)、チェーンコード処理回路(9)を順に具え、該チェーンコード処理回路(9)は、切換えスイッチ(8)を介して、2つのコード列メモリ(40)(41)に選択的に接続する。切換えスイッチ(8)の近傍には、CPU(4)が設けられ、該切換えスイッチ(8)は、CPU(4)により切り換えられる。コード列メモリ(40)(41)の出力端は、比較回路(5)に接続されている。比較回路(5)からの図形情報は、描画回路(6)に送られ、描画回路(6)は描いた画像をディスプレイ(7)に表示する。以下、各回路の動作を図3及び図4のフローチャートを用いて説明する。

【0008】まず、カメラ(10)により、基準となる錠剤(2)の画像を取り込む(S1)。取り込まれた錠剤(2)の画像を、2値化処理回路(30)にて所定のスレッショルドレベルで、図11に示すように2値化処理する(S2)。この後、2値化画像はノイズ処理回路(31)にて、収縮及び膨張からなるノイズ除去処理を施す。収縮処理とは次に示すものである。収縮処理前の画素状態を図12(a)に、収縮処理後の画素状態を図12(b)に示す。図12では、図形要素を'1'で、それ以外の画像部分をドットで示す。

【0009】先ず画面を画素単位の区画に分割し、画面上の各画素を検出する。そして、画素がドットである地点の上下左右に位置する画素を画面から消す。例えば、図12(a)に於いては、2行2列目の画素が'1'であり、上下左右の画素がドットであるから、図12(b)に於いては、該2行2列目の画素がドットとなる。膨張処理とは、収縮処理とは逆に任意の画素の上下左右に位置する地点に、画素がない場合に画素を生じさせる処理である。図12(c)は図12(b)に示す画素状態を膨張処理した後の画素状態である(前記「画像処理の基本技法」(技術評論社発行)54頁～56頁参照)。このような収縮・膨張処理を数回施すことで、ノイズは除去される。

【0010】ノイズが除去された後の画像は、チェーンコード処理回路(9)に送られる(S3)。CPU(4)は切換えスイッチ(8)を、一方のコード列メモリ(40)に繋ぐ。ここで、チェーンコード処理とは、画像の輪郭線上に、基準点と複数の分割点を設定し、基準点に対する各分割点の向きを、方向コードと呼ばれる数字で表わし、画像の輪郭を数字列で表現するものである(「コンピュータ画像処理」(産報出版)93頁～95頁参照)。方向コードとは、図5に示すように、基準点に対する分割点の方向を、0～7までの数字で順に示したものである。

基準点に対する分割点の方向が、0～7までの方向に一致しない時は、最寄りの方向コードで示す。本実施例に於いては、図6に示すように、まずX－Y座標上に、錠剤(2)の輪郭を設けるとともに、該輪郭線上に時計方向に、互いに離れた4つの点A、B、C、Dを等間隔に設定する。最初の基準点をAとし、その座標を(0、0)とする。この後に、A～B、B～C、C～D、D～Aの4つの区間について、夫々複数の分割点を等間隔に設定して、後述するように、各分割点の座標位置を方向コードで表わし、各区間長についてチェーンコード配列を作成する。尚、錠剤(2)の形状は円形であるが、図6では説明の便宜上、8角形に近似して示す。

【0011】チェーンコード配列の手順は以下に示される。各区間内に於いて、複数の分割点を等間隔に定める。図6に示す例では、角部に1つの分割点(20)を、該点(20)と点A、Bとの間に、夫々分割点(21)(22)を定める。次に基準となる点に対し隣の点がどの方向に位置しているかを、Aから順に左回りに検索し、方向コードで表わす。実際のチェーンコード処理では各区間内に於いて、多数の分割点を設定するが、図6では説明の便宜上、分割点を3つとする。

【0012】図6に於いて、基準点Aに対し反時計方向側で隣り合う分割点(21)は、X軸の負方向かつY軸の正方向に位置する。即ち、分割点(21)の方向コードは、図5に示す「5」のコードになる。チェーンコード処理回路(9)は一旦「5」のコードを記憶し、分割点(21)の座標を(－1、1)とする。次に、基準点を分割点(21)に置き換え、該点(21)から反時計方向側で隣り合う分割点(20)を測定する。分割点(20)の方向コードは「5」になる。チェーンコード処理回路(9)は先に記憶した「5」のコードに続けて、分割点(20)の方向コードである「5」を記憶し、該点(20)の座標を(－2、2)とする。

【0013】以下、同様の操作を繰り返すと、区間A～Bに於いては、チェーンコード配列は5566となり、点Bの座標は(－2、4)となる。以下、上記操作を他の区間に於いても実施し、錠剤(2)の輪郭線全周の分割点についてチェーンコード配列を得る。チェーンコード配列は、切換えスイッチ(8)を介してコード列メモリ(40)に記憶される。尚、各分割点の座標は、後記するように、比較回路(5)にてチェーンコード配列から復元される。

【0014】図3のフローチャートにて、基準となるべき錠剤(2)のチェーンコード配列が、コード列メモリ(40)に格納完了されると(S5)、使用者は検査画像を取り込むか否かを決める(S6)。検査画像を取り込むときは、ベルトコンベア(12)を操作して、検査すべき錠剤(2)をカメラ(10)に対向した位置に設定する。CPU(4)は切換えスイッチ(8)を切り換えて、先にチェーンコード配列が記憶されたコード列メモリ(40)とは異なるコード列メモリ(41)と、チェーンコード処理回路(9)を

電気的に接続する(S7)。画像処理回路(3)は検査すべき錠剤(2)の画像についても、上記と同様の処理を行なって、得られたチェーンコード配列をコード列メモリ(41)に格納する。

【0015】コード列メモリ(41)にチェーンコード配列が入力完了されると、CPU(4)は比較回路(5)を操作し、比較回路(5)は両コード列メモリ(40)(41)に格納されたチェーンコード配列から得られる区間長を各区間毎に比較する(S8)。例えば、区間A～Bに於いては、チェーンコード配列は5566と4つのコードから成るので、区間長は4である。比較回路(5)には予め各区間毎に区間長の許容誤差、及び各コードから読み取れる各分割点の座標の許容誤差が記憶されている。ここにおいて、区間長の許容誤差及び各分割点の座標の許容誤差は、基準となる錠剤(2)に対し、欠けや膨らみがあっても、錠剤(2)の効能上許される量から決定される。また、例えば図8に示すように、錠剤(2)の周囲に亘って僅かな凹凸が連続した形状であれば、区間長が許容誤差を越えるにも拘らず、錠剤(2)の効能上、許されるものもある。かかる錠剤(2)まで不良と看做さないように、区間長の許容誤差に加えて、各分割点の座標の許容誤差まで設定しているのである。

【0016】比較回路(5)は1つの区間に於いて、区間長の差が許容誤差内であれば(S9)、次の区間について比較する。比較回路(5)は錠剤(2)の輪郭全周について比較を行なったか否かを判断し(S11)、全ての区間に於いて、許容誤差以内であると判断すれば、異常なしとの信号を発する(S12)。1つの区間に於いて、チェーンコード配列から得られる区間長の差が許容誤差外であれば、ステップS10に移行し、コードから分割点の座標を復元し、該区間内の点の座標どうしを比較する。座標差が許容誤差以内であれば、次の区間の区間長を比較する(S11)。座標差が許容誤差を越えていれば、比較回路(5)は、該区間内に欠陥があると判断し、許容誤差を越える分割点の座標を、描画回路(6)に送る。描画回路(6)は、比較回路(5)が欠陥と判断される箇所を描き(S13)、ディスプレイ(7)に表示する(S14)。

【0017】フローチャートのステップS8からS14に示される比較回路(5)の動作を、図7に示すように、区間A～Bにて、凹み(28)がある場合を想定して具体的に示す。以下の記載に於いて、区間長の許容誤差を1と、座標の許容誤差を0.5と夫々仮定する。凹み(28)は分割点(20)から点Bに亘って形成され、予めチェーンコード処理回路(9)にて、チェーンコード配列が作成されている。凹み(28)の輪郭上には、3つの分割点(23)(24)(25)が設定され、分割点(23)から点Bまでのチェーンコード配列は0664となる。従って、区間A～Bに於いては、チェーンコード配列は550664となり、区間長は6となる。前述の如く、錠剤(2)の正規の画像では、チェーンコード配列は5566であり、区間長が4であるから、区間長の差は2となる。比較回路(5)は、区間長の差が許容誤差以上であるから、区間A～B内に不良箇所があることを判別する。基準点Aから2つめの分割点(20)までは、コードが一致し、該点(20)から点Bまでの間で、コードが異なるから、この間に、不良箇所があることが判る。

【0018】比較回路(5)は、不良箇所を示すコード列0664から、各分割点(20)(23)(24)(25)の座標を求める。次に、該座標と基準画像の座標を比較する。図9(a)は区間A～Bに於ける基準画像のコード列と座標を、図9(b)は検査画像のコード列と座標を、夫々表わしたものである。両画像の座標を比較すると、分割点(22)及び凹み(28)上の分割点(23)(24)(25)の座標については、相手側の画像の座標に対して許容誤差内に納まるものがない。即ち、検査画像に示される錠剤(2)は、基準画像に示される錠剤(2)の画像に対し、区間A～Bに於いて、不良箇所があることが判る。比較回路(5)は、不良箇所を構成する分割点(22)(23)(24)(25)、及び分割点(23)(24)(25)を挟む点Bと分割点(20)の座標データを描画回路(6)に送る。描画回路(6)は該座標データに基づいて、図形を描く。

【0019】該図形は、図10に示すように凹み(28)があることを示す長方形状となり、ディスプレイ(7)には、凹み(28)の図形及び区間A～Bが示される。このようにして錠剤(2)の不良箇所の区間及び形状が判る。ディスプレイ(7)を見ている作業者は、該錠剤(2)が不良であると判断したときには、錠剤(2)を取り出し、ディスプレイ(7)に表示された区間により、不良箇所とその形状を素速く確認できる。尚、不良と判断された錠剤(2)を、不良箇所とその形状を確認した後に、ベルトコンベア(12)にて更に搬送する。この後に、画像処理回路(3)に連繋した取出し装置(図示せず)により、該錠剤(2)を抜き取ることもできるが、該取出し装置は、公知技術であり記載を省略する。

【0020】本実施例に於いては、錠剤(2)の輪郭を、所定の区間に区分けし、区間毎に不良箇所を検索し、不良箇所があればその形状を表示する。従って、錠剤(2)の全面積や全周長を比較する従来の装置に比して、不良箇所の発見が素速くでき、不良箇所の位置も容易に特定できる。本実施例に於いては、被検査物として錠剤を例示したが、錠剤に限らず、種々の形状の検査装置に本実施例が応用可能であるのは、言うまでもない。

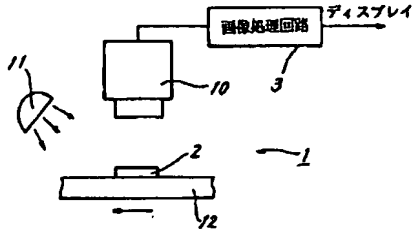
【0021】上記実施例の説明は、本発明を説明するためのものであって、特許請求の範囲に記載の発明を限定し、或は範囲を減縮する様に解すべきではない。又、本発明の各部構成は上記実施例に限らず、特許請求の範囲に記載の技術的範囲内で種々の変形が可能であることは勿論である。

【図面の簡単な説明】

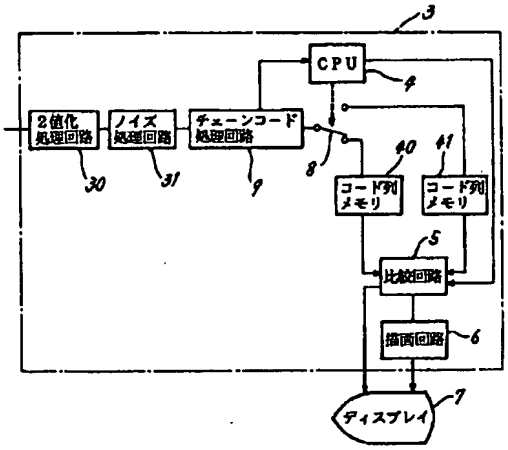
【図1】形状検査装置の全体構成を示す図である。

【図2】画像処理回路の回路構成を示すブロック図である。
【図3】画像処理回路内の処理を示すフローチャートである。
【図4】画像処理回路内の処理を示すフローチャートである。
【図5】方向コードを示す図である。
【図6】基準画像の分割点を示す図である。
【図7】検査画像の分割点を示す図である。
【図8】錠剤の周囲に凹凸があるときの分割点を示す図である。
【図9】(a)は基準画像の、(b)は検査画像の、夫々チェーンコード配列と、座標を示す図である。
【図10】錠剤の凹みを示す図である。
【図11】2値化画像を示す図である。
【図12】収縮・膨張処理を示す図である。
【符号の説明】
(4) CPU
(5) 比較回路
(9) チェーンコード処理回路
(10) カメラ
(40) コード列メモリ
(41) コード列メモリ

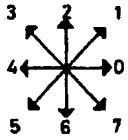
【図1】



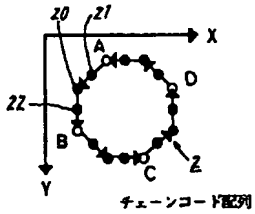
【図2】



【図5】

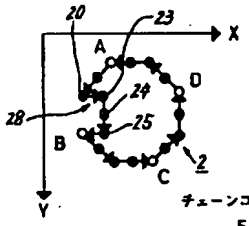


【図6】



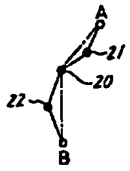
5566
A　B

【図7】

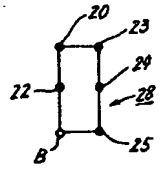


550664
A　B

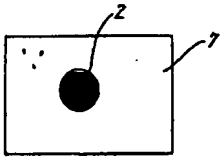
【図8】



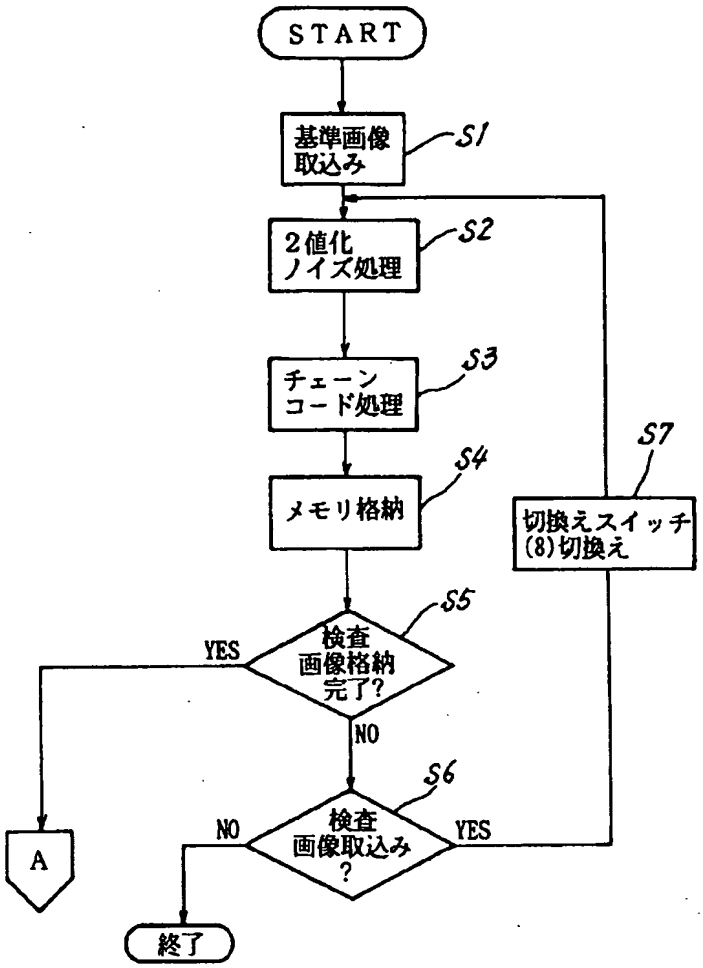
【図10】



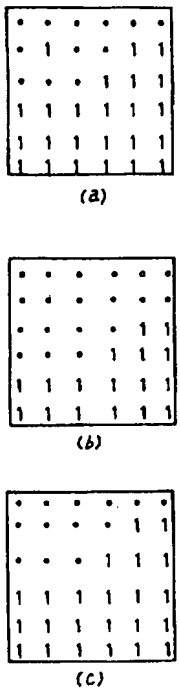
【図11】



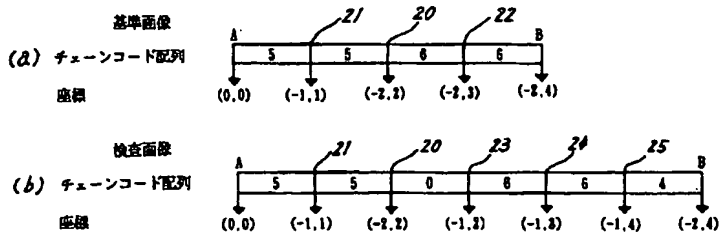
【図3】


START
基準画像取込み
S1
2値化ノイズ処理
S2
チェーンコード処理
S3
メモリ格納
S4
切換えスイッチ(8)切換え
S7
検査画像格納完了?
S5
YES
NO
検査画像取込み?
S6
NO
YES
A
終了

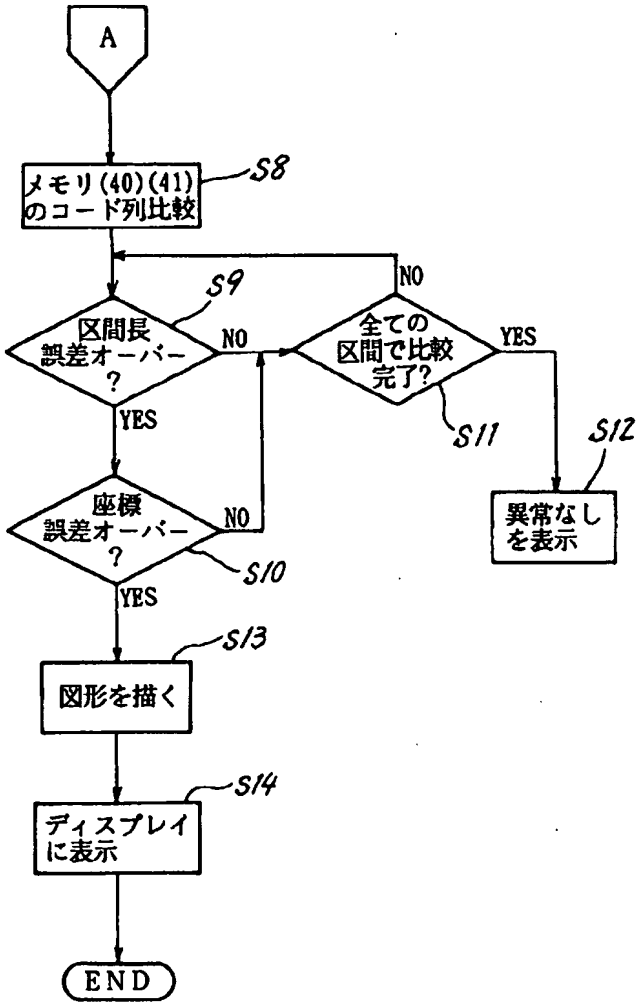
【図12】


(a)
(b)
(c)

【図9】


基準画像
(a) チェーンコード配列
座標
A
B
21
20
22
5
5
6
6
(0,0)
(-1,1)
(-2,2)
(-2,3)
(-2,4)
検査画像
(b) チェーンコード配列
座標
A
B
21
20
23
24
25
5
5
0
6
6
4
(0,0)
(-1,1)
(-2,2)
(-1,3)
(-1,3)
(-1,4)
(-2,4)

【図4】


A
メモリ(40)(41)のコード列比較
S8
区間長誤差オーバー?
S9
NO
YES
全ての区間で比較完了?
NO
YES
S11
S12
異常なしを表示
座標誤差オーバー?
NO
S10
YES
S13
図形を描く
S14
ディスプレイに表示
END